

## **WORLD TRADE CENTER EXPERT TECHNICAL REVIEW PANEL**

This document contains written comments received from individual panel members on the "Draft Proposed Sampling Program to Determine Extent of World Trade Center Impacts to the Indoor Environment" (October 15, 2004 external review draft)

### **Comments of Patricia Clark**

The slag wool remains the best candidate for a "marker". (I use this term rather than signature because the constituents of the buildings and subsequent fire were not unique to the WTC event.) There is insufficient significant information to define a signature at this time. I do believe that there can be sufficient information to establish a workable marker, such as slag wool, that can be used within recognized limitations. A background level evaluation, broader than that yet done is required for an attempt to determine where levels are significantly above those that might have been deposited by localized demolition or installation of like products.

The original list of COPCs in our opinion is adequate and was peer reviewed for residential clean up.

Three times background has basis in EPA procedures and so appears to be acceptable to use to provide consistency with EPA work

I agree with Dr. Lioy that the statistical design of the sampling was done under the constraint of volunteer participation. This places an enormous strain on scientific or statistical sampling strategies. Although quite complicated, I agree that participational biases were not accounted for in the plan.

As a possible solution to the expected difficulty in securing participation in the attempt to determine the geographic extent of the spread of WTC contaminants, OSHA supports using Federal, State, and City buildings. They could also be used as a screening tool in Brooklyn locales adjacent to Lower Manhattan. This might fill in gaps in sampling distribution if voluntary participation is not forthcoming

Dr. Lippman's recommendations are sound: acquisition of determinative samples, determine the level of significance above background for the slag wool fibers, and evaluate the relative amounts of the COPCs.

These comments do not represent OSHA policy and only pertain to the WTC cleanup project. OSHA requirements are set by statute, standards and regulations. Our interpretation and opinions of the sampling plan apply to particular circumstances, but they cannot create additional employer obligations.

## **Comments of Commander Peter W. Gautier**

1. The ability to establish a WTC signature still holds the best promise for determining the location and extent of remaining WTC contamination. The presentations by Dr. Meeker and Dr. Rosati have been very encouraging, although the presentation of 5 background sample results and off-line conversations with Dr. Meeker have made me concerned that the May 31 deadline will be met with sufficient samples and analyses to gain confidence in the results. This effort needs to be a priority, with sufficient resources devoted to it. It would be wise, as David Newman wrote, to define objective criteria by which a signature could be evaluated so that we know "what success looks like" beforehand. There will be gaps in this method; one weakness is the lack of samples taken 2001-2002 at distance from Ground Zero to determine whether slag wool and COPCs remain in WTC dust in consistent ratios at different distances from the WTC site.
2. The panel has been instructed from its first meetings not to take cost into consideration. The cost discussions during the February meeting have been a departure from previous meetings. As a technical panel, it is important that recommendations not be influenced by the constraints of a particular budgetary ceiling. However, execution of a sampling and cleanup plan and any follow up actions most certainly will be cost-constrained, so proposed details of sampling and cleanup must stand a reasonable chance of successfully characterizing and minimizing remaining exposures and risks from WTC dust. It is sometimes tempting to forget when immersed in the details of proposals that this effort will not take place in a laboratory, but in a densely populated, dynamic community.
3. I applaud what sounded like positive consideration for expanding the sampling program to include a portion of Brooklyn. This only makes sense considering the proximity of Brooklyn to Ground Zero and the known direction of dust and smoke plumes. Creating a preliminary sampling boundary to the east of the WTC site into Brooklyn similar to the distance of proposed sampling to the north sounds reasonable. Without Brooklyn sampling, there would be no way of knowing whether Phase II sampling is necessary there since the large swath presented by the East River would not be bounded by sampling data.
4. Cleanup should be triggered if any WTC dust is found in a space above a benchmark. This includes dust discovered in inaccessible areas. These areas are the most likely to have remaining WTC contaminants. The proposed sampling program does not state clear rationale which justifies leaving contamination in place based on its location; it assumes that contaminants in inaccessible areas are less of an exposure risk. Perhaps, but I would hate to explain to a tenant that she has WTC contamination behind her refrigerator that would be cleaned up if only it were in front of her refrigerator.

5. I recommend that before execution the sampling and cleanup plan be "operationalized". By this I mean that the plan needs to be crafted into a document containing clear instructions to those who have to execute it. In the emergency response business, we take objectives and strategies (and documents like sampling plans) and craft them into incident action plans which spell out the tactical details of an operation. I think this would be very helpful in leaving as little as possible to chance in the execution of the plan. For example, detailed direction is necessary to ensure that different sampling teams are taking samples from similar locations in similar spaces. QA/QC needs to be more fully fleshed out. Contractor oversight needs to be defined. This type of plan also becomes an invaluable historic and legal document down the road. In the early meetings of the panel, we heard much criticism from the community that EPA's (and contractors') sampling and cleaning of apartments was very sloppy. This can't happen again if this is to be a creditable effort.

## **Comments of Dr. Paul J. Liroy**

I have formulated five specific observations and/or recommendations for consideration in developing the final sampling and analysis plan on residual WTC contamination and its further cleanup.

1. If we are going to succeed in identifying locations which have residual WTC contamination and recommend cleanup, the EPA needs to be able to demonstrate that there is WTC residuals indoors. This will help a potential volunteer understand that we are not just on a fishing expedition that is looking for the presence of toxicants indoors. With the above in mind, the efforts of Dr. Meeker have brought us very close to a signature for the Initial Dust and Smoke Plume caused by the Building Collapse (IDSPBC), but we are months away from a plume signature. Therefore, since the highest potential for WTC residuals is associated with the mass of material initially released by the collapse, the sampling plan should initially be tailored to obtain samples from locations impacted by the IDSPBC.

2. Sampling should be completed in Brooklyn, NY. A reasonable approach would be to extend the radius distance that was used to include Houston Street to the north for the IDSPBC, to a similar boundary to the east in Brooklyn. However, the EPA would be wise to review the anecdotal information that has been provided to the committee by the public about visual observations of the initial dust and smoke in Brooklyn. The latter would be used to augment a final decision about an easterly boundary.

3. The identification of COPC's in a dust sample is not as important as identifying and characterizing the signature for the IDSPBC. However, the EPA must also clearly articulate the criteria for clean up. The former should be done as expeditiously as possible and the latter should not be far behind.

The EPA has given itself a deadline of May 31, 2005 for having a validated signature. *They should make every effort to attain that goal, and concurrently work with the Panel to define appropriate criteria for clean up.* Based upon the current direction of the signature development program, a clean up decision should be *based primarily upon a percent, or the # of slag wool fibers found in a dust sample.*

*The criteria for cleanup must include, at a minimum, places where significant levels of slag wool are found in a building, including residences or workspaces, whole buildings and source locations. Sampling undisturbed or remote areas (including HVAC ducts and vents) are an important part of the sampling design, and will provide the best opportunity for identifying the presence of WTC residuals.*

4. Based upon the discussion during the meeting, the EPA needs to consider changes to the building selection statistical design. There appears to be no mechanism available for conducting anything other than a sampling program based upon the recruitment of volunteer buildings (public or private), and owned or rented residences. We must accept that fact, and the building selection criteria needs to account for the biases that such a program will generate. At the same time, the Community must fully engage itself in the promotion of the volunteer sampling program.

Completion of a successfully sampling and clean up program for WTC residuals is the best interest of the community and the EPA. Therefore, a concerted effort needs to be made by both the Community and the EPA to develop a plan for recruitment once a final sampling plan has been completed for the program.

5. The signature development plan needs to provide a clear definition of the proportionality of levels of non- volatile COPC's to the levels of slag wool found in original WTC samples at a variety of locations and distances from ground zero. For those more distant locations without samples ( e.g. beyond Chambers street and across the East River) a rationale for either assuming that the proportionality remains constant or changes needs to be articulated in the final signature document. There will be uncertainties in the IDSPBC proportions selected for the locations more distant from ground zero. However, a rationale will provide all with an understanding of the process used to estimate the change or the lack of change in the proportion of IDSPSC expected at distant locations which lack 9-11-01 dust samples. The Panel should be helpful in achieving this milestone.

Final comment. It is a pleasure to serve with each member of the WTC Panel. The Professionalism displayed during each meeting has been superb, and, personally, you have helped me complete my responsibilities as Vice Chair. The purpose and design sampling program has come a long way, and I look forward to its successful implementation during 2005.

## **Comments of Dr. Morton Lippmann**

The report of the CBPR Comm. has, unfortunately, done little to advance either the WTC community's understanding of the complex issues involved in the design and implementation of a constructive plan for the sampling and analysis of residual WTC contamination and its further cleanup, or the progress of our WTC Expert Technical Review Panel. I credit the CBPR Comm. with a good faith effort to be constructive, but they were greatly handicapped by both the limited time that they had to complete their report and recommendations, and by their limited knowledge about the constraints on the resources likely to be available for the task. As a result, their recommendations, while seeming to be reasonable for the the acquisition of much information that would be desirable for an ideal risk assessment, were not constructive the task we face. Furthermore, by emphasizing so many hypothetical risks for which the currently available evidence is quite limited, it has the potential to increase, rather than decrease, the fears of the WTC community concerning health risks. Considering what we do know, it is highly likely that most of hypothesized risks associated with the re-suspension of the residual indoor dust will be well within current guidelines.

The CBPR Comm. also recommended that an expanded list of COPCs be sampled and analyzed without any apparent consideration whether the data that would be collected could be inform-ative about levels of continuing exposures and their associated health risks. I will briefly touch on the bases for the judgements made above on some specific issues raised by the CBPR Comm.

### **Measurements of Short Asbestos Fibers**

Since the landmark report of the Health Effects Institute-Asbestos Research (HEI-AR, 1991), it has been clear that short asbestos fibers (i.e., those shorter than  $5\mu\text{m}$  in length) pose little, if any, health risk, and that the standard analyses, that count all asbestos fibers are seldom adequate to define the concentrations of the longer fibers that do pose cancer risks.

The primary physiologic basis for counting only fibers greater than  $5\mu\text{m}$  in length this specification is the ability of alveolar macrophages to phagocytose and subsequently clear shorter asbestos fibers from the airways. The longer the fiber, the lower the probability that a macrophage will successfully ingest and clear the fiber from the air passages. Multiple references support this correlation between fiber length and pathogenicity as well as the corresponding use of  $5\mu\text{m}$  as a length threshold. I published a review of data from experimental animal studies (Lippmann, 1988) evaluating the data in rats exposed by inhalation and injection to fibers of varying sizes in which I concluded that mesothelioma and lung cancer are most closely associated with numbers of fibers greater than  $\sim 5\mu\text{m}$  and  $\sim 10\mu\text{m}$  respectively. I reached similar conclusions that supported a 5 or  $10\mu\text{m}$  cut-off size by way of regression analysis of the animal inhalation data (Lippmann, 1994). Lending further support to such a cut-off, a 2003 Eastern

Research Group report, prepared for the Agency for Toxic Substances and Disease Registry (ATSDR) entitled the "Report on the Expert Panel on Health Effects of Asbestos and Synthetic Vitreous Fibers: The Influence of Fiber Length", stated, "Many of the short fibers that reach the gas exchange region of the lung are cleared by alveolar macrophages, and the rate of clearance by phagocytosis has been found to vary with fiber length—there is a strong weight of evidence that asbestos and SVFs (synthetic vitreous fibers) shorter than 5mm are unlikely to cause cancer in humans." Similarly, in another 2003 report prepared by the Eastern Research Group for the US EPA, it is stated that there was agreement among the panelists convened that "the available data suggest that the risk for fibers less than 5 $\mu$ m in length is very low and could be zero." Lending yet further support to the use of a 5 $\mu$ m length threshold, the HEI-AR [Health Effects Institute - Asbestos Research] 1991 report, entitled *Asbestos in Public and Commercial Buildings: A Literature Review and Synthesis of Current Knowledge*, quite clearly states in its section on fiber length:

"While the differential responses to fibers of different lengths cannot yet be specified precisely, the data suggest that the risks of lung cancer and mesothelioma increase with increasing fiber length. In particular, a substantial body of experimental evidence suggests that the rates of induction of tumors and fibrosis in animals, as well as transformation of cells in vitro, increase sharply as fiber length increases above 5 $\mu$ m. Thus, the conventional definition of an asbestos fiber used for industrial hygiene purposes (fibers longer than 5 $\mu$ m with an aspect ratio of 3 and greater) continues to be a practical index for risk assessment; the use of this index also facilitates comparison of present observations with those in the earlier literature. Whether there is any length threshold below which there is no carcinogenic effect in humans is not known. Animal data suggest, however, that very short fibers have much less carcinogenic activity than longer fibers and may even be relatively inactive".

Independent analyses of published data from studies having data on length distributions and biological outcomes have added to the evidence of the risks of long fibers (Berman and Crump, 1998). While I recognize that there are still some dissenting views on this issue, I do not find them persuasive.

## **Measurements of Dioxin and other Fire Plume Contaminants**

While dioxin and dioxin-like chemicals are potential cancer causing compounds, the EPA supported sampling program of indoor spaces in 2002 did not find evidence that the indoor environments sampled warranted health concerns. Since there is no known way for levels to have increased since 2002, there is no reason to devote scarce resources for additional dioxin measurements. There is also no good reason to devote scarce resources to the measurement of other fire plume components, even though the exposures to them in late 2001 may have contributed to the health effects that have been reported in studies of lower Manhattan residents and workers. Most of the fire plume contaminants are sufficiently volatile that that the residues after 3.5 years after their dispersion are likely to be below any practical detection limits. Also if they are still present as organic coatings on surfaces, the likely extent of their re-suspension as inhalable particles would be very low.

## **Signature Chemicals and Possible Delays in Cleanup**

The concerns expressed by the CBPR Comm. about reliance on unvalidated signature chemicals were certainly valid on the basis of the evidence that they had in hand. However the data made available to the WTC Panel for the Feb. 23, 2005 meeting by Dr. Meeker on background levels of slag wool fibers at six New York City sites distant from the WTC have alleviated much of our Panel's previous concerns about the utility of slag wool fibers as a signature for the WTC collapse dust.

The CBPR Comm. recommendation that cleanup not be delayed while the signature is being validated is illogical, and perhaps irresponsible insofar as they offered no guidance on the selection of units warranting cleaning.

## **MY RECOMMENDATIONS FOR NEXT STEPS**

Further development of the slag wool fiber signature method, and the initiation of procedures for implementing it, warrant immediate attention, and inclusion as a discussion item at our next WTC Panel meeting. This should include:

- 1) The acquisition and analysis of samples from intermediate sites between ground zero and the boundaries of interest (e.g., Houston St. and Brooklyn Heights).
- 2) Definition of a significant level of WTC dust accumulation (e.g., 3, 5, or 10 slag wool fibers per area scanned).

- 3) Further determination of proportionality of slag wool and other non-volatile components of WTC Panel interest, and their variability, if any, with distance from the WTC (to help in defining patterns of COPCs of WTC origin).

## **REFERENCES CITED**

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## **Comments of Greg Meeker**

I would like to reiterate what others on the panel have said. I believe we have come a long way in the last year and are moving in the right direction. The process often seems slow and sometimes painful but progress has been substantial. We must keep in mind that 9/11 was an unprecedented event presenting tremendous challenges to the health and analytical communities. I believe these challenges are being addressed with care and concern for the community, occasionally displayed by fervent debate. The spirited discussions on February 23 were not only appropriate but a necessary part of the scientific process. Any suggestion to the contrary demonstrates a lack of understanding of the discipline. I would also like to add that it is a privilege to be working with such a knowledgeable and dedicated group of people. I believe that everyone involved is doing the best they can to provide the best possible solution to an extremely difficult problem.

As to the specific issues in the proposals there are a few comments and concerns I have regarding sampling and analysis.

- I agree that testing should be conducted in Brooklyn. I believe the best approach would be to start near the East River along the direction of the 9/11 plume and move toward the southeast as indicated by analytical results. This sampling and analysis can be an iterative process. I don't believe specific boundaries are necessary at this time. The extent of sampling could be based on analytical results after background levels are determined.
- I agree with Dr. Carpenter's group that attention needs to be paid to likely differences in dust compositions within and between sampling units. I don't believe that sampling strategies within individual sampling units has been given enough attention. I don't think this is a major flaw but something that needs more work.
- An immediate concern is acquiring a sufficient number of individual background samples (not composites) to begin to get a statistically valid picture of the frequency of higher levels of slag wool, or other materials that might interfere with signature measurement. I believe this number will be very low for residential units but it might be somewhat higher for commercial spaces. It is important that we understand these differences as we begin to think about establishing background levels. The five samples USGS has analyzed show an exceedingly low background for slag wool. The more background samples EPA can collect and analyze the more confidence we will have in these low background values and our ability to detect low levels of WTC dust mixed with other dusts.

- Although I am not overly concerned at this time about fractionation of dust signature components with distance from the source, it is clear that others are. We did discuss this issue in the very early stages of the signature work and noted that fractionation should be evaluated. This is a very difficult problem to deal with so long after the event. Had samples been collected for this purpose early-on it would be a non-issue but we must deal with what we currently have available. I believe that even though three plus years have passed since the collapse of the WTC there are likely still small pockets of residual WTC dust that could be located and sampled. Such pockets might be found in protected areas on roof tops, doorways, window casings and other cracks or crannies that could trap and hold dust. Looking for this material would require a slightly different approach to collection. Rather than random sampling of interior spaces, an effort should be made to locate protected and undisturbed areas, both indoor and outdoor, for collection of small amounts (0.1 to 1 gram would be sufficient) of residual WTC dust. I don't believe this would be a major effort requiring great expense. This could proceed radially out from the WTC site beyond the limits of original bulk sample collection. There is a very good possibility that these samples can be collected at the various GSA facilities that are available for sampling. The specific purpose of these samples would be to evaluate possible fractionation of signature components with distance and elevation. I am not suggesting this as an alternative to the proposed sampling but as an addition. We might be able to tease some information out of "regular" samples to shed some light on this issue but it is likely that any evidence of fractionation will be unclear unless the samples have high concentrations of WTC dust. The only other way I can think to address this issue would be to model particle flow. This approach would be extremely difficult if not impossible given the extreme turbulence of the initial dust cloud and the later effects of wind, water, settling, thermal plumes, and adhesion. I believe any attempt to simplify the problem by simply using relative settling velocities in air would lead to erroneous results.
- I am somewhat disturbed by the discussion of the signature work in the community expert report. To read the report one would think that the signature work is years away from completion and that it may never be workable. This is far from the state of the current development and the data demonstrating this was available to the group. The signature work is well on its way toward completion with every indication that it will prove very useful.
- With regard to the validation study, the USGS data have shown that the practical detection limit for slag wool using SEM is very low (ppm to even ppb range). Given this, it is important that any constructed validation samples be prepared in the proper concentration ranges. I would suggest 10, 1, 0.1, and maybe even 0.01 wt % added WTC dust. This will give

confidence to the community as to the viability of the method. How these samples are prepared will be critical. Considerable experience is required to produce large quantities of homogeneous reference materials. If these reference samples are not prepared correctly and properly tested the study will be useless. It must be very clear that any inconsistency in the results of a validation study is due to problems with the method and not with preparation of the reference samples used in the study. Also, as currently outlined, the validation study to be conducted by contract laboratories is an analytical methods validation study, not a study to determine background levels. We must be sure these two important tasks are not confused.

# **WORLD TRADE CENTER EXPERT TECHNICAL REVIEW PANEL**

**comments of**

**DAVID M. NEWMAN<sup>1</sup>**

**with regard to:**

**Draft Proposed Sampling Program to Determine Extent  
of World Trade Center Impacts to the Indoor Environment<sup>2</sup>;**

**Determination of a Diagnostic Signature for World Trade Center Dust  
and Scanning Electron Microscopy Point Counting Techniques<sup>3</sup>;**

**WTC Community-Labor Coalition Comments  
on EPA's "Draft Proposed Sampling Program..."<sup>4</sup>; and**

**Expert Advisory Committee Synthesis Report - CBPR Expert Advisory Committee  
Review of the Document Entitled "Draft Proposed Sampling Program..."<sup>5</sup>**

**March 1, 2005**

## **1. MANDATE**

As we approach the first anniversary of the EPA World Trade Center Expert Technical Review Panel, it may be useful to revisit the panel's mandate. The October 27, 2003 letter from the White House Council on Environmental Quality to Senators Clinton and Lieberman directs the panel to:

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<sup>1</sup> New York Committee for Occupational Safety and Health (NYCOSH).

<sup>2</sup> EPA/600/R-04/169A, October 15, 2004, [www.epa.gov/wtc/panel/pdfs/sampling-proposal-20041015.pdf](http://www.epa.gov/wtc/panel/pdfs/sampling-proposal-20041015.pdf).

<sup>3</sup> United States Geological Survey, Meeker, et al., open file report 2005-1031, [pubs.usgs.gov/of/2005/1031/OF2005\\_1031\\_508.pdf](http://pubs.usgs.gov/of/2005/1031/OF2005_1031_508.pdf).

<sup>4</sup> January 18, 2005, [docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId=090007d480595a32](http://docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId=090007d480595a32).

<sup>5</sup> January 18, 2005, [docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId=090007d480595a32](http://docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId=090007d480595a32).

- “characterize any remaining exposures and risks;
- identify unmet public health needs, and;
- recommend steps to further minimize risks associated with the aftermath of the World Trade Center attacks.”<sup>6</sup>

In my opinion, to fulfill our mandate the panel must address the following issues:

- determination of the geographic extent of any remaining World Trade Center (WTC) contamination, identification of remaining WTC-derived contaminants, if any, in indoor spaces, determination of whether remediation is warranted, and remediation if and where warranted;
- identification and oversight of disturbance of potential secondary sources of WTC-derived contaminants, such as demolition of WTC-contaminated high-rise buildings in Lower Manhattan and associated debris removal and waste transfer operations;
- assessment of health registry tracking of post-exposure risks by workers and residents;
- assessment of adequacy of access to and provision of health care services for 9/11-impacted individuals and communities, and;
- assessment of the need for further research, including areas of inquiry and possible sources of funding.

## **2. SAMPLING PROGRAM PROGRESS**

Substantial progress has been made by EPA on the design of the proposed sampling program, encompassing to varying degrees many of the suggestions made by panel members and by community and labor representatives, and spurred by the formalization of a Community Based Participatory Research Process (CBPR). Improvements in the program, in my opinion, include abandonment of the “asbestos as surrogate” concept, expansion of the geographic area to be sampled, inclusion of workplaces and indoor commercial and public spaces in the sampling plan, and testing for a suite of potential contaminants.

Also of note is the proposed switch from air sampling to surface dust sampling. Although the relationship between surface load and the potential for resuspension, exposure, and health risk is not well understood, surface dust sampling is useful in

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<sup>6</sup> Council on Environmental Quality, letter to Senators Clinton and Lieberman, October 27, 2003, page 2, [www.epa.gov/wtc/panel/pdfs/Clint-Lieb-ltr.pdf](http://www.epa.gov/wtc/panel/pdfs/Clint-Lieb-ltr.pdf).

certain circumstances and mirrors the regulatory requirements of New York State<sup>7</sup> and New York City<sup>8</sup> asbestos regulations, which utilize bulk dust samples as triggers for abatement and which utilize air sampling (under aggressive conditions) only for post-cleanup clearance. EPA itself previously used microvacacs to sample porous surfaces for WTC lead and asbestos in its Residential Confirmation Cleaning Study.<sup>9</sup> Use of dust sampling and jettisoning of air sampling increase the likelihood of community participation in the sampling program by minimizing the potential for significant disruption or damage in the home or workplace.

### **3. UNRESOLVED SAMPLING ISSUES**

The following sections touch on some (but not all) of the sampling issues that I feel warrant further consideration by EPA and by the panel. Although time constraints prevent a more complete treatment in this document, I look forward to a robust discussion of these and other issues with panel members.

#### **3A. LIMITATIONS**

As I stated to the panel almost a year ago,<sup>10</sup> the limitations of any sampling program must be clearly defined. In particular, appropriate end use of data and limitations on end use must be unambiguous. The presence or absence of contaminants at this late date should not be used to extrapolate backwards in time to draw conclusions about the presence or absence of contaminants at an earlier date. In the absence of health-based benchmarks, no correlation should be made between sampling results and risk or lack of risk. However, downtown residents and workers must be given accurate information as to the potential hazards of exposure to sampled contaminants. The aforementioned limitations must be prominently incorporated in all communications pertaining to the sampling program.

#### **3B. GOALS**

The primary goal of the sampling effort should be to identify WTC-derived contaminants, if any, that remain in indoor spaces, to determine whether remediation is warranted, and to provide remediation if and where warranted. A secondary goal should be to utilize data accumulated in this effort to determine the nature and geographic extent of any remaining WTC contamination.

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<sup>7</sup> New York State Industrial Code Rule 56, [www.labor.state.ny.us/business\\_ny/employer\\_responsibilities/safety/s56.htm](http://www.labor.state.ny.us/business_ny/employer_responsibilities/safety/s56.htm).

<sup>8</sup> New York City Asbestos Abatement and Control Rules and Regulations, [www.ci.nyc.ny.us/html/dep/pdf/asbestos.pdf](http://www.ci.nyc.ny.us/html/dep/pdf/asbestos.pdf).

<sup>9</sup> United States Environmental Protection Agency, Region 2. Interim Final WTC Residential Confirmation Cleaning Study, Volume 1. May 2003, [www.epa.gov/wtc/confirmation\\_clean\\_study.htm](http://www.epa.gov/wtc/confirmation_clean_study.htm).

<sup>10</sup> [www.epa.gov/wtc/panel/pdfs/newman-2-20040412.pdf](http://www.epa.gov/wtc/panel/pdfs/newman-2-20040412.pdf).

### 3C. WTC SIGNATURE

I expect that the effort to validate a proposed PAH (polycyclic aromatic hydrocarbons) signature will not be successful due to differences in combustion sources, distinct combustion events, volatility over time, degradation from exposure to ultraviolet light, and other factors.

Presentations by Greg Meeker at recent panel meetings indicate that substantial progress has been made in our ability to identify slag wool that is WTC-derived. The ability to identify slag wool that is of WTC origin is a significant step forward in the process of validating slag wool as a WTC signature. However, at this point in time, validation of slag wool as a WTC signature must be considered premature, for the following reasons:

- Identification of slag wool of WTC origin thus far has been predicated on analysis of a small number of samples obtained from a limited geographic area (below Chambers Street). We must exercise caution in drawing any conclusions about the ability to identify WTC-derived slag wool beyond the area from which the samples were obtained.
- Differences in ratios of surface area to mass may have resulted in particle size segregation of contaminants by distance and elevation. Larger, heavier particles such as slag wool typically would not be expected to travel as far as lighter particulates such as chrysotile, thus reducing the potential utility of slag wool as a WTC signature beyond a limited geographic area. On the other hand, an exceptional event such as the force of the WTC collapse may have propelled slag wool fibers further than would be expected under normal conditions. More data are needed on this issue.
- Slag wool fibers may be less prone to resuspension than are contaminants of potential concern (COPCs) such as chrysotile asbestos. Consequently, it is possible that over time slag wool fibers that have settled out on indoor surfaces may have been more likely to have been removed through normal cleaning activities than other COPCs which may have been resuspended rather than removed. It is therefore possible that WTC-slag wool is now absent in some WTC-impacted indoor spaces while COPCs may remain. Were such a scenario to occur, the sampling proposal as currently written, particularly with its emphasis on accessible spaces, would improperly exclude these COPCs from identification as WTC-derived.
- Several panelists have commented on the issue of the degree of reliability of a slag wool signature (or any signature). Anything less than 100% certainty, which is not achievable, may result in false positives or false negatives. False positives may bias interpretation of sampling results by indicating the absence of COPCs in indoor spaces that are incorrectly presumed to be WTC-impacted. In this

scenario, indoor spaces that were not impacted by 9/11 events and thus have no residual 9/11 contamination will be counted as impacted but without residual contamination, thus skewing the data to show that fewer impacted spaces have residual contaminants. False negatives, on the other hand, may inappropriately rule out remediation of COPCs that may be present.

In a broader context, I believe the search for a WTC signature has been fundamentally compromised by the failure to articulate in advance a precise definition of a signature and to specify clear and objective criteria by which to evaluate the validity of candidate substances. In my opinion, the criteria proposed by Weisel<sup>11</sup> for validation of a surrogate are applicable as well to the search for one or more WTC signature substances:

- the proposed signature substance must be a component of all dispersed materials;
- the proposed signature substance must not become separated from other substances during dispersion;
- the ratio of the proposed surrogate to other contaminants must be consistent (and remain consistent over time and with disturbance), and;
- remediation must be as effective for all contaminants as it is for the proposed signature substance (or remediation and clearance testing must be substance-specific).

Stated differently, it is my understanding that scientific inquiry proceeds through the formulation of a hypothesis and the implementation of a testing process to either prove or disprove and revise the hypothesis. In the search for a WTC signature, I am not aware that any hypothesis has been postulated.

The sampling proposal in its current version is entirely dependent upon the determination of a valid signature. At this point in time, although progress has been made, there is no way of knowing with certainty whether or when a valid signature will be identified. The presentation to the panel on February 23, 2005 by Jacky Rosati anticipates “final results/validation” by May 31, 2005.<sup>12</sup> This means that a sampling plan cannot be rolled out before June at the earliest. As I have pointed out to the panel on several occasions, the sampling proposal collapses without a signature. As I have also pointed out, no “Plan B” has been proposed.

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<sup>11</sup> Weisel, Clifford. “Scientific Input on Issues Related to EPA’s Response Activities to the Attacks on the World Trade Center,” Task Order #59, EPA Contract 68-C-02-060, [www.epa.gov/wtc/panel/pdfs/weisel.pdf](http://www.epa.gov/wtc/panel/pdfs/weisel.pdf).

<sup>12</sup> National Homeland Security Research Center, “Development of WTC Dust and Fire Screening Methods,” [www.epa.gov/wtc/panel/pdfs/Rosati-20050223.pdf](http://www.epa.gov/wtc/panel/pdfs/Rosati-20050223.pdf).

In fact, the current proposal states that if a signature is not validated, “the WTC Expert Technical Review Panel and the Community Based Participatory Research planning group will be asked to evaluate the overall results of the sampling program and provide EPA with their interpretation of the results.”<sup>13</sup> This is absolutely ludicrous. It is unrealistic to expect that Lower Manhattan residents, landlords, or employers (workers are excluded under the proposal) will let EPA in the door in the absence of a clearly defined sampling plan with a clear decision process and a clear commitment to cleanup where warranted. Consequently, it is highly unlikely, in my opinion, that there will be any results to evaluate or that any sampling at all will occur.

### 3D. CONTAMINANT RESERVOIRS

Reservoirs are materials or areas that accumulate and retain contaminant substances and that have the potential to release these substances over time or upon disturbance. Release has the potential to increase exposure and health risk. There are only limited data available on release and retention rates, and the mechanics of retention and release are not well understood. Three types of contaminant reservoirs are addressed in the sampling proposal - porous surfaces, inaccessible spaces, and heating, ventilation, and air conditioning (HVAC, or mechanical ventilation) systems.

The sampling proposal calls for porous surfaces such as carpets to be sampled for asbestos, man-made vitreous fibers (MMVF), and crystalline silica. The proposal restricts testing for lead and polycyclic aromatic hydrocarbons (PAHs) to hard surfaces only, and does not offer scientific or methodological rationales for their exclusion from testing on porous surfaces.

EPA elsewhere acknowledges that carpets can hold large amounts of lead dust, that carpet dust-lead loading can be high, and that lead levels in carpet dust tend to have a significant positive association with children's blood-lead concentration.<sup>14</sup> In a 1995 document, EPA describes 9 different vacuum methods for lead dust sampling.<sup>15</sup> EPA in the past has been able to collect and evaluate PAHs from carpets using the High Volume Small Surface Sampler (HVS3), a high powered vacuum cleaner equipped with a sampling nozzle that can be adjusted to a specific static pressure within the nozzle as well as a cyclone to fractionate particles collected.<sup>16</sup> A variation on HVS3 collection of

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<sup>13</sup> U.S. Environmental Protection Agency, “Draft Proposed Sampling Program to Determine Extent of World Trade Center Impacts to the Indoor Environment,” EPA/600/R-04/169A, October 15, 2004, page 11, [www.epa.gov/wtc/panel/pdfs/sampling-proposal-20041015.pdf](http://www.epa.gov/wtc/panel/pdfs/sampling-proposal-20041015.pdf).

<sup>14</sup> U.S. Environmental Protection Agency, “Summary and Assessment of Published Information on Determining Lead Exposures and Mitigating Lead Hazards Associated with Dust and Soil in Residential Carpets, Furniture, and Forced Air Ducts - Executive Summary,” December 1997, EPA 747-S-97-001, [http://www.epa.gov/lead/cfad\\_ex.htm](http://www.epa.gov/lead/cfad_ex.htm).

<sup>15</sup> U.S. Environmental Protection Agency, “Sampling House Dust for Lead - Basic Concepts and Literature Review, Final Report.” EPA 747-R-95-007, September 1995, [www.epa.gov/lead/r95-007.pdf](http://www.epa.gov/lead/r95-007.pdf).

<sup>16</sup> U.S. Environmental Protection Agency, “Analysis of Soil and House Dust for Polycyclic Aromatic Hydrocarbons,” EPA600/Sr-96/060, May 1996, [www.epa.gov/ORD/WebPubs/projsum/600sr96060.pdf](http://www.epa.gov/ORD/WebPubs/projsum/600sr96060.pdf).

PAHs from carpets has also been reported in a study of pesticides and other compounds in carpet dust.<sup>17</sup>

Because reservoirs offer the potential for the release and bioavailability of retained contaminants, and because reservoirs, by definition, offer high potential for sample collection, and because technologies for sample collection from soft surfaces are well documented in the scientific literature, porous surfaces such as carpets should be sampled for all COPCs included in any sampling plan.

The current sampling plan proposes to exclude samples collected from “inaccessible areas” such as “behind or on top of cabinets” from clean-up decision-making. I find the comments of the CBPR Expert Advisory Comment persuasive on this issue:

[There are] less contaminated accessible locations, while a reservoir accumulates in infrequently cleaned and/or inaccessible locations. Consequently results from none of the sampling should be excluded from cleanup decision-making criteria. If it is determined based upon program objectives and statistically based sampling design that samples are to be collected from a particular location then the results should be considered part of the cleanup criteria. Dust samples present in inaccessible locations, like those found in HVAC ducts or ceiling plenums, represent the most significant reservoirs of contaminated dusts available for introduction into residential living space and workspace alike....These reservoirs must receive the highest priority in the sampling program design....If inaccessible areas and/or soft surfaces are found to be contaminated enough to be a source of exposure, they should be cleaned, or, in the case of soft surfaces, removed. Cleaning should target the reservoirs of the toxics. Also samples collected from “inaccessible areas” are a good indicator or surrogate of past contamination.<sup>18</sup>

With regard to HVACs, EPA’s proposed sampling plan calls for sampling of outdoor air inlets, air mixing plenums, discharge outlets, and HVAC filters. In my opinion, this aspect of the proposal places a higher priority on convenience of access than it does on obtaining scientifically useful results. The presentation of Les Sparks, EPA’s ventilation expert, to the panel on June 22, 2004, clearly noted that deposition is most likely to occur at duct work “dead spots” - i.e., at bends in high velocity areas as well as in areas of low velocity.<sup>19</sup> These areas should be included for sampling in the sampling plan.

### 3E. COPCs

The proposed sampling plan considers and rejects dioxin as a plan COPC, based on

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<sup>17</sup> Colt, et al., “Comparison of Pesticides and Other Compounds in Carpet Dust Samples Collected from Used Vacuum Cleaner Bags and from a High-Volume Surface Sampler.” Environmental Health Perspectives. Volume 106, Number 11, November 1998, [ehp.niehs.nih.gov/members/1998/106p721-724colt/colt-full.html](http://ehp.niehs.nih.gov/members/1998/106p721-724colt/colt-full.html).

<sup>18</sup> Expert Advisory Committee Synthesis Report - CBPR Expert Advisory Committee Review of the Document Entitled “Draft proposed Sampling Program...” January 18, 2005, [docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId](http://docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId).

<sup>19</sup> U.S. Environmental protection Agency, “Particles and HVAC Systems,” [www.epa.gov/wtc/panel/pdfs/sparks-20040622.pdf](http://www.epa.gov/wtc/panel/pdfs/sparks-20040622.pdf).

results of EPA's Indoor Air Cleanup program in 2002. The proposal does not consider, however, findings of elevated levels of dioxin in at least five commercial and government buildings near Ground Zero (90 Church Street, 100 Church Street, 30 West Broadway, 130 Liberty Street, and 4 Albany Street). It is noteworthy that EPA early on characterized (outdoor) dioxin emissions as follows:

Typical [dioxin] urban air concentrations are in the range of 0.10 to 0.20 pg TEQ/m<sup>3</sup>... The WTC and Church & Dey measurements from...September 23 through November 21 show unambiguous elevation, with concentrations ranging from about 10 to 170 pg TEQ/m<sup>3</sup>... The 6 Park Row measurements between October 12 and 29 averaged 5.6 pg TEQ/m<sup>3</sup>... The highest TEQ concentration reported in the US was >1.0 pg/m<sup>3</sup>, downwind of an incinerator...Certainly, no reports in the literature could be found on similar circumstance where there is, what is essentially, an area source at ground level continually emitting dioxin near to where individuals are exposed. It would be reasonable to conclude that the concentrations to which individuals could potentially be exposed, in the range of 10.0 to 170.0 pg TEQ/m<sup>3</sup> within and near the WTC site found through the latter part of November, are likely the highest ambient concentrations that have ever been reported.<sup>20</sup>

The proposed sampling plan does not consider mercury for sampling inclusion, also not taking into account elevated levels found at several downtown commercial and government buildings. The R.J. Lee Group, Inc., the primary environmental consultant for Deutschebank, conducted extensive tests for elemental mercury at 130 Liberty Street in December 2003 and January 2004. Mercury surface concentrations were found to average 1.32 µg/ft<sup>2</sup>, to a maximum of 58.7 µg/ft<sup>2</sup>. The highest mercury levels were found on the surfaces of structural steel. Mill scale averaged 0.53 ppm, with a maximum of 1.5 ppm, exceeding the New York State soil cleanup objective of 0.1 ppm. Cutting of steel in the gash area resulted in mercury levels in excess of the OSHA Permissible Exposure Level (PEL). Average concentrations in air in the gash area during non-cutting operations were 11, 12, 13, and 17 ng/m<sup>3</sup>; average concentrations in air during cutting were 204, 177, 275, and 107 ng/m<sup>3</sup>. Ambient indoor mercury levels, measured with a Lumex Analyzer, averaged 90 ng/m<sup>3</sup> compared to 5 to 20 ng/m<sup>3</sup> in other Manhattan buildings and to less than 5 ng/m<sup>3</sup> outdoors. Identical indoor heated (83°F) and unheated office spaces (<60°F) were compared. The heated space averaged 92 ng/m<sup>3</sup>, with spikes from 160 to greater than 300 ng/m<sup>3</sup>, in excess of the ATSDR Minimum Risk Level and the EPA IRIS Inhalation Reference Concentration. The unheated space averaged 37 and 18 ng/m<sup>3</sup>.<sup>21,22</sup>

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<sup>20</sup> National Center for Environmental Assessment, USEPA, "Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster," EPA/600/P-2/002A, October 2002, pages 75 - 77, [oaspub.epa.gov/eims/eimscomm.getfile?p\\_download\\_id=36387](http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=36387).

<sup>21</sup> R.J. Lee Group, Inc., "Mercury Assessment, 130 Liberty Street Property, Technical Memorandum H2: Mercury Air Monitoring," May 2004, [www.nyenvirolaw.org/WTC/130%20Liberty%20Street/Mike%20Davis%20LMDC%20130%20Liberty%20Documents/Mercury/H2\\_TechMemo.050704.1505.L3.pdf](http://www.nyenvirolaw.org/WTC/130%20Liberty%20Street/Mike%20Davis%20LMDC%20130%20Liberty%20Documents/Mercury/H2_TechMemo.050704.1505.L3.pdf)

<sup>22</sup> R.J. Lee Group, Inc., "Mercury Assessment, 130 Liberty Street Property, Expert Report: Mercury," May 2004, [www.nyenvirolaw.org/WTC/130%20Liberty%20Street/Mike%20Davis%20LMDC%20130%20Liberty%20Documents/Mercury/Mercury\\_ExpertReport.051104.2010.so.pdf](http://www.nyenvirolaw.org/WTC/130%20Liberty%20Street/Mike%20Davis%20LMDC%20130%20Liberty%20Documents/Mercury/Mercury_ExpertReport.051104.2010.so.pdf).

Given the well-documented findings of dioxin and mercury in some Lower Manhattan indoor spaces, it would seem prudent to consider their inclusion in the sampling plan, at least on a limited basis and near to Ground Zero.

### 3F. SHORT FIBERS

The debate over whether short fibers, less than five microns in length, demonstrate harmful biological activity has passionate and knowledgeable scientists on both sides of the question, including some members of our panel. The issue remains controversial and unresolved and certainly will not be settled by this panel. In the absence of scientific or medical consensus, it is always better to have more data. I believe it is appropriate to collect, count, and report short fibers in this sampling effort.

### 3G. GEOGRAPHIC EXTENT OF SAMPLING

The exclusion of Brooklyn from Phase 1 of the proposed sampling plan means that it is possible, or even likely, that no sampling will take place there under this proposal. As panelists have repeatedly indicated, failure to sample in Brooklyn is unacceptable. Initial testing must include, at a minimum, those areas of Brooklyn immediately across the river from Lower Manhattan, below the equivalent of a line drawn from Houston Street (south of approximately Grand Street in Brooklyn).

### 3H. CHEMICAL MIXTURES

Simultaneous exposure to multiple contaminants may produce adverse health impacts through additive or synergistic effects beyond those anticipated from the respective toxicities of individual components. The proposed sampling plan is silent on the issue of chemical mixtures. The potential for exposure to multiple contaminants should be considered by a revised sampling plan. Although there is very limited history of interventions for protection against mixed exposures upon which to draw, initial guidance may be found in both occupational health and environmental regulations. OSHA's Air Contaminants Standard (29 CFR 1910.1000) specifies an exposure additivity formula to compute reduced workplace exposure limits for chemical mixtures.<sup>23</sup> The National Contingency Plan (40 CFR 300.430) requires consideration in remedial investigations of cases involving multiple contaminants or pathways which will result in cumulative risk of  $10^{-4}$  excess cases.<sup>24</sup>

### 3I. ACCESS AND PARTICIPATION

The comments of the WTC Community Labor Coalition are persuasive on the issue of access and participation:

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<sup>23</sup> [www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9991](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9991).

<sup>24</sup> [a257.g.akamaitech.net/7/257/2422/12feb20041500/edocket.access.gpo.gov/cfr\\_2004/julqtr/pdf/40cfr300.430.pdf](http://a257.g.akamaitech.net/7/257/2422/12feb20041500/edocket.access.gpo.gov/cfr_2004/julqtr/pdf/40cfr300.430.pdf).

Although the plan allows for individual residential tenants to self-enroll, access to common spaces and to mechanical ventilation systems is to be controlled by the landlord, and access to workplaces is to be controlled by the employer. This arrangement effectively disenfranchises the overwhelming majority of downtown residents and workers by preventing them from requesting sampling, and possibly cleanup, of their indoor spaces.<sup>25</sup>

This situation is a significant disincentive to community support of, and participation in, a sampling effort, and may ultimately doom any such sampling effort.

This issue cannot be resolved without clarification of EPA's right of access or lack thereof to private and public property. EPA has made clear its position that it prefers and plans to implement a strictly voluntary process. On the other hand, EPA has refused to provide, despite repeated requests from panel members and community and labor representatives, a legal memorandum that delineates its powers and limitations in gaining access to private and public property. Regardless of the position that EPA chooses to take on the access issue, it should provide the legal memorandum, as requested.

#### **4. POTENTIAL IMPEDIMENTS TO SUCCESS OF SAMPLING PLAN**

While residential and labor representatives have been advocating for and strongly support a comprehensive sampling effort, their support for the current proposed plan is not yet certain. Without their support, any sampling effort will have little chance of success. Even with their support, the ability to gain the trust and cooperation of the larger community should not be taken for granted. The following potential substantial impediments to the success of a sampling plan have not yet been addressed by the panel or the agency, but need to be:

- the lack of a clear and unequivocal commitment on the part of the government to remediation, where sampling results warrant, and the methodologies and clearance tests associated with such remediation;
- adequacy of the budget for sampling and remediation;
- the content, timing, and methods for outreach and public health education efforts to be associated with a sampling effort, and the nature of community participation in these efforts;
- guarantees of adequate QA/QC measures, and acknowledgment of failures in QA/QC during the previous residential cleanup program.

Community and labor buy-in to a sampling effort is also likely to be impacted by the

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<sup>25</sup> Expert Advisory Committee Synthesis Report - CBPR Expert Advisory Committee Review of the Document Entitled "Draft proposed Sampling Program..." January 18, 2005, [docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId](http://docket.epa.gov/edkpub/do/EDKStaffItemDetailView?objectId).

transparency and effectiveness of EPA in assuming its proper lead-agency, proactive coordination role in oversight of the demolition of contaminated high rise buildings in Lower Manhattan. These demolitions constitute imminent and pressing unmet public health needs associated with the aftermath of the WTC attacks, and as such, are part of the mandate of the panel.

## **Comments of Krish Radhakrishnan**

- Sampling methodologies employed in this program should be consistent with the sampling methodologies employed in previous programs including the background studies. The use of consistent methodology will permit more effective comparisons of the results. We had a brief conversation with Nilfisk regarding the specifications for the GM 80 HEPA vacuum (the GM 80 replaced the GS 80 and basically has a stronger motor) and the four stages of filtration. The paper bags capture particle sizes greater than 10 mm; the cotton main filter: 4 mm; the micro-filter: 2mm; and the HEPA filter: 0.3mm. It is our understanding that the sample collected in the collection bag is the one that will be analyzed. We recommend reconsideration of the Nilfisk HEPA vacuum for sampling.
- This sampling program should be used to collect data for evaluation and for attainment of the program goals and objectives. Decisions for cleaning should be based on sampling results at individual units and not based on building characterization.
- Where a validated signature is not present but COPC exceedances are found, a mechanism must be in place (prior to sampling) to notify the tenant(s) within a reasonable period of time of such exceedances and of available remedial measure(s) that should be taken. Furthermore, the decision not to include units with COPC exceedances in "less cleaned" areas should be reconsidered. The potential of re-entrainment is sufficient reason to include the units in a clean-up program
- Consideration must be provided for general notations during the initial survey and sample collection regarding the condition of each unit in the event that re-accessing the space is not possible. This is particularly important in the evaluation of lead and asbestos levels. Additionally, a corollary investigation should be included for the collection of information regarding the HVAC systems, including the normal maintenance and cleaning of HVAC components and the filter changing schedules since September 11, 2001.

### **Follow-up question from Dave Newman to Krish Radhakrishnan**

Point of clarification: You wrote that were the GM 80 were to be used "It is our understanding that the sample collected in the collection bag is the one that will be analyzed." Which is the collection bag you refer to - the paper bag that captures particle sizes greater than 10 mm, the cotton main filter at 4 mm, the micro-filter at 2mm, or the HEPA filter?

### **Response from Krish Radhakrishnan**

I referred [to] the paper bag as the collection bag that captures particle sizes greater than 10mm .